TENNESSEE HIGHER EDUCATION COMMISSION

Agenda Item: I.A.6.

DATE: July 14, 2005

SUBJECT: University of Memphis, Bachelor of Science in Biomedical Engineering

ACTION RECOMMENDED: Approval

BACKGROUND INFORMATION: The proposed Bachelor of Science in Biomedical Engineering (B.S.B.E.) degree is expansion of an interdisciplinary academic program introduced in 2003 as a student-contract program leading to the Bachelor of Professional Studies in University. In January 2003, the Batelle Institute presented a report regarding the strengths and challenges of Memphis as a biotechnology center. In July 2004 the commission approved an A.A.S. at Southwest Tennessee Community College in response to requests for entry-level laboratory technicians in biotechnology. Training in that program encompasses microbiology, molecular biology, chemical application and laboratory management and safety in order to function in a research, healthcare, or industrial biotechnology environment.

An undergraduate program in biomedical engineering will provide a critical link for developing a discipline at the University of Memphis that is pertinent to "biotechnology." This term, is sometimes used for statistics related to economics and business, includes medical devices, especially if they include biological or pharmaceutical factors. Individuals working in such fields thus move about widely within a range of applicable majors in the sciences (microbiology, molecular and cellular biology, physiology, physics, chemistry, biochemistry, mathematics and statistics) and engineering (primarily biomedical engineering, mechanical and electrical engineering).

PROPOSED START-UP DATE: Fall 2005

Commission staff has reviewed program proposals according to the academic standards adopted by the Commission on November 14, 2002. Each standard is referenced below.

1.1.20A MISSION: The proposed program is consistent with the role and score of the university mission "to provide a stimulating academic environment for its students in an urban setting." The university, "through its research, teaching and outreach roles responds to individual needs, such as the support of health care and preventive health services."

1.1.20B CURRICULUM: The proposed curriculum is already established under the Bachelor of Professional Studies; therefore, no new courses are required. The proposed program requires completion of 128 semester credit hours, a discipline-based exception to 120 hours requirements distributed as follows:

Curriculum Components	Hours Required
General Education	42
College and Degree Requirements	29
Major	37
Electives	20
TOTAL:	128

1.1.20C ACADEMIC STANDARDS: The program will follow the current requirements for admission, retention, and graduation for the UoM and the Herff College of Engineering as published in the *Undergraduate Catalog.*

Projected Program Productivity

Student Projections	Full-time Enrollment	Part-time	Graduates
Year 1	14	2	0
Year 2	28	4	0
Year 3	42	8	0
Year 4	56	12	8
Year 5	70	16	12

1.1.20D FACULTY: There are currently eight faculty of the University of Memphis component of the Joint Graduate Program in Biomedical Engineering. These faculty members will have primary responsibility for the proposed BSBE degree program. Faculty will have various levels of research support from funded grants. Approximately 35% time on the average will be devoted to undergraduate instruction. Other than part-time faculty on an as-needed basis, no additional faculty members are required. Part-time faculty will be available from local health-related organizations and practitioners in local industry and the faculty of the College of Health Science Engineering at the University of Tennessee Health Science Center in Memphis.

A search process to fill one Chair of Excellence and one junior faculty position in Biomedical Engineering has been completed and a search for a second Chair of Excellence will be initiated next year. This process will complete expected faculty lines in the Department of Biomedical Engineering. Candidates who are being interviewed have stressed the importance of an undergraduate program for the health and vitality of the total educational effort. New faculty will rebalance work assignments from primarily graduate to both undergraduate and graduate education. The ultimate size of the program could be larger if externally supported research program and associated graduate effort and the undergraduate program all grow simultaneously.

1.1.20E LIBRARY RESOURCES: No additional library resources are required to implement the proposed program. Library needs will be met by the McWherter Library, which now provides materials for the graduate program in biomedical engineering.

1.1.20F ADMINISTRATION/ORGANIZATION: The proposed baccalaureate degree program in Biomedical Engineering will be housed in the existing Department of Biomedical Engineering of the Herff College of Engineering.

1.1.20G SUPPORT RESOURCES: The Regional Medical Center of Memphis will partner with the University of Memphis, providing research collaborations, opportunities for internships and employment.

1.1.20H FACILITIES/INSTRUCTIONAL EQUIPMENT: Appropriate computer hardware and software resources are available through several computer laboratories located in the Herff College of Engineering and throughout the campus. These resources are provided and regularly improved through the Technology Access Fee.

Specific laboratory space for laboratories in the undergraduate program are needed to obtain American Board of Engineering Technology (ABET) accreditation. Space that is adjacent to the Department of Biomedical Engineering became available as the Architecture program moved into the Department of Art facilities in August 2004. Much of their space will be converted to engineering laboratory space with minor effort and limited cost. Funds of $100,000 from the Herff Trust (approved by the Trustees contingent upon approval of the proposed degree program) and of $40,000 from an industrial gift will be used to equip this space. Several laboratories are maintained by other engineering programs and will be used by the biomedical engineering majors as they take courses in those programs that are pertinent to the individual programs of study. Appropriate computer hardware and software resources are currently available. Specific laboratory space for laboratories in the undergraduate program are needed to obtain ABET accreditation.

1.1.20I STUDENT/EMPLOYER DEMANDS: BSBE graduates work in the biological and physical sciences within the engineering profession to solve problems in industry or other sites with manufacturing and in research or development areas that involve medical devices, products, and processes, especially the development, production, and use in the field.

Graduates also are prepared for advanced studies in biomedical engineering, quantitative applied biology, other fields of engineering and sciences, and professional schools (i.e., medicine, dentistry, law, and business). The end result is a degree program aligned with educational needs in a rapidly developing economic area of particular importance to West Tennessee and the nation.

Evidence of demand and need for Biomedical Engineering is grounded in the growth of biology and medicine as quantitative sciences, which created the demand for persons who can translate information and blend it with other aspects of technology. The proposed degree program in biomedical engineering will train a group of individuals to deploy knowledge of quantitative aspects of biology in forms related to a wide range of technical products and services. For example, joint replacements, medical devices, instruments for modern diagnostic measurements, medical imaging, and new processes involved in minimally invasive surgery are outcomes that involved biomedical engineering.

Regional development in the Mid-South and particularly West Tennessee is dependent on the availability of a professional workforce and particularly biomedical engineers. Memphis is in an economic area with a large concentration of industry producing biomedical devices and biotechnology. The current West Tennessee concentration,

with respect to production of orthopedics and musculoskeletal devices, rank 4th in 64 of the largest metropolitan areas, when population size is a controlled variable.

1.1.20J NO UNNECESSARY DUPLICATION: The only other state-supported undergraduate biomedical engineering degree program is at UT Knoxville. For new freshman matriculating there in the fall 2001, the biomedical engineering program was the most popular choice of all the engineering programs other than the "undecided" category. Currently there are no undergraduate biomedical engineering programs at state-assisted institutions in Arkansas, Mississippi or Missouri.

1.1.20K COOPERATIVE INSTITUTIONS: The University of Tennessee Health Science Center and the University of Memphis implemented a joint M.S. and Ph.D. in Biomedical Engineering in 1996. Faculty and student collaborations will also occur at the bachelor's level.

1.1.20L DESEGREGATION: The program will not impede the state's effort to achieve racial diversity.

1.1.20M ASSESSMENT/EVALUATION AND ACCREDITATION: The department chair or designee will be responsible for administering the course evaluations, major field tests, and exit interviews. Evaluation of all university programs are administered through the Office of the Provost. The program will be evaluated using several measures to assess student achievements:

- Scores on standardized tests such as the Fundamentals of Engineering Exam (FE) and the Graduate Record Exam (GRE)
- Review of projects completed for the capstone course, BIOM 4780
- Admission to graduate and professional programs
- Exit interviews with all graduating seniors and follow up questionnaires
- The number of students employed by industry within six months of graduation

The program will be submitted for accreditation by the Accreditation Board for Engineering and Technology. There are no SACS implications.

1.1.20N ARTICULATION: N/A

1.1.20O EXTERNAL JUDGMENT (Graduate Programs): N/A

1.1.20P COST/BENEFIT/SOURCE: Most funds originate from continuation of now vacant positions, which are being aligned more closely with regional industry and work within the initiative in "biotechnology" in the Memphis area. Such funds come in large part from the Herff Trust established to develop the Herff College of Engineering.

FINANCIAL PROJECTIONS

	Year 1	Year 2	Year 3	Year 4	Year 5
1. Expenditures					
A. One – time:					
New/renovated space	$10,000				
Equipment	$130,000				
Library					
Consultants (evaluation)	$3,000				$3,000
Other					
Total for One-time Expenditures	**$143,000**				**$3,000**
B. Recurring:					
Administration					
Faculty	$6,000	$10,000	$13,000	$16,000	$20,000
Staff	$8,000	$8,000	$8,000	$8,000	$8,000
Benefits	$4,200	$5,400	$6,300	$7,200	$8,400
Equipment					
Library					
Travel	$4,000	$4,000	$4,000	$4,000	$4,000
Other	$4,000	$4,000	$4,000	$4,000	$4,000
Total for Recurring Expenditures	$26,200	$31,400	$35,300	$39,200	$20,500
TOTAL (A + B)	**$169,200**	**$31,400**	**$35,300**	**$39,200**	**$47,400**
2. Revenues					
State appropriations (new FTE)					
*State appropriations (old)					
Tuition/Fees	$36,540	$73,080	$112,056	$151,032	$190,008
Institutional Resources					
Grants/Contracts[1]	$100,000				
Gifts[2]	$40,000				
Other (in-kind donations, etc.)					
TOTAL REVENUES	**$176,540**	**$73,080**	**$112,056**	**$151,032**	**$190,008**

[1] Funds approved by the Herff Trust for the current fiscal year pending approval of program.
[2] Funds provided by a corporate donor and held in a departmental gift account.

1.1.30 POST APPROVAL MONITORING: An annual performance review of the proposed program will be conducted for the first five years following approval. The review will be based on goals established in the approved program proposal. At the end of this period, campus, governing board, and Commission staff will perform a summative evaluation. These goals include, but are not limited to enrollment and graduation numbers, program costs, progress toward accreditation, library acquisitions, student performance and other goals set by the institution and agreed upon by governing board and Commission staff. As a result of this evaluation, if the program is found to be deficient, the Commission may recommend that the governing board terminate the program. Copies of such recommendation will be forwarded to the Education Committees of the General Assembly. The Commission may also choose to extend this period if additional time is needed and requested by the governing board.